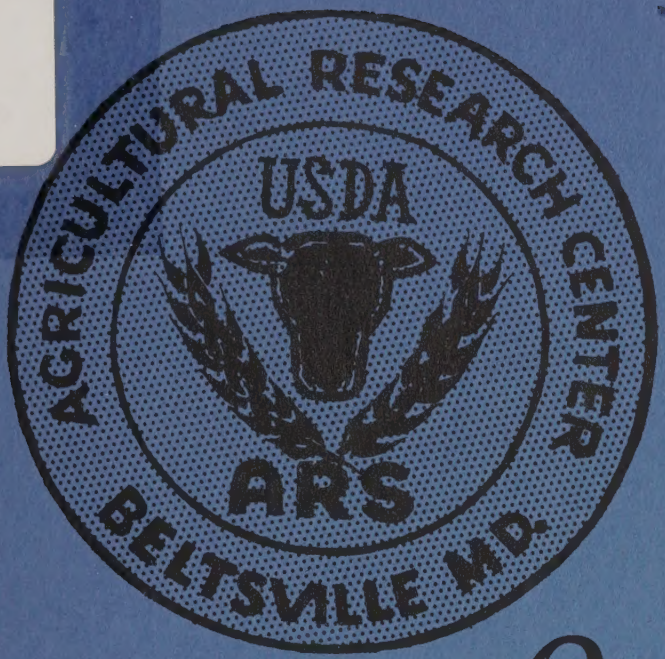

Organization & Program

AGRICULTURAL RESEARCH SERVICE
U. S. Department Of Agriculture

UNITED STATES DEPARTMENT OF AGRICULTURE

AGRICULTURAL RESEARCH SERVICE

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Organization and Program of the
AGRICULTURAL RESEARCH CENTER
Beltsville, Maryland

C O N T E N T S

THE AGRICULTURAL RESEARCH CENTER

The Agricultural Research Center at Beltsville, Maryland, lies like a large green island in the sea of shopping centers, housing developments, and superhighways that spans the Washington-Baltimore corridor. Bisected by U.S. Route 1 into Agricultural Research Center East (The Farm) and Agricultural Research Center West (Plant Industry Station), the Center collectively is an area landmark.

But its pastoral beauty belies the true nature of the Agricultural Research Center. It is, in fact, a dynamic complex of research activity that has made major contributions to revolutionizing American Agriculture. Established in 1910, the Center rapidly achieved its position as the leading and most diversified agricultural research complex in the world. Its international repute attracts visiting scientists from many countries.

Because of the dedicated research of scientists of various disciplines, Americans today spend only 15.5 percent of their disposable income for food of excellent quality and wide diversity, and their food is the safest of any in the world. Within the last several years, increasing concern over environmental quality has led to new research endeavors to insure prevention of pollution of soil, water, air, and plants in both rural and urban areas.

Organizational structures have changed periodically over the years. In 1972, research at Beltsville was realigned into nine Institutes, comprising 67 Laboratories. Each of these Institutes is concerned with one or more areas of study designed to provide continuing solutions to ever-changing problems and needs. This publication briefly describes these research programs, and lists the names of the Institute Chairmen and Laboratory Leaders. Other activities located at the Center also are described.

AGRICULTURAL ENVIRONMENTAL QUALITY INSTITUTE

L. L. Danielson, Chairman
Rm. 233, Bldg. 001, (South Bldg. ARC-W)
Phone: 344-3030

Man's environment - air, soil, and water - may be affected favorably or unfavorably by agricultural production. Research in this Institute is devoted to developing agricultural practices that minimize or avoid damaging the environment.

Because of the vast and increasing need of the world for food and fiber, the Institute is also searching for ways to reduce the adverse effects of pollution on agricultural production.

Research is underway to develop safer pesticides; devise cultural, mechanical, and biological alternatives to objectionable pesticides; measure the degradation of pesticides and determine effects of heavy metals in air, soil, water, and plants; develop means of using sewage sludge to improve agricultural soils; develop systems for recycling animal wastes; revegetate desolated strip-mine areas; and identify the effects of air pollutants on plants.

Agricultural Chemicals Management Laboratory

A. W. Taylor, Leader

How pesticides, fertilizers, and pollutant metals such as the heavy metals affect the environment and how these effects can be controlled by improved management practices are studied in this Laboratory. The objective of this research is to improve agricultural management, productivity, and food quality, while minimizing possible hazards to the environment from agricultural chemicals.

Work on pesticides emphasizes nonpersistent carbamate insecticides. Lead, cadmium, and mercury are being scrutinized closely in an attempt to understand their soil chemistry. Present work on fertilizers is directed toward development of improved criteria for soil testing, so that farmers can avoid applications of phosphate fertilizers except when actually needed.

Air Pollution Laboratory

H. E. Heggestad, Leader

The effects of air pollutants on a broad spectrum of plant species are investigated, and technology for minimizing and preventing air-pollution damage to plants is developed. Most of the research involves work with ozone, sulfur dioxide, and ethylene - all major gaseous pollutants in the Northeastern United States.

Plant-damaging concentrations, especially of ozone, exist occasionally in rural areas of this region. Facilities are available to exclude pollutants by filtration, so that yield and quality of plants in clean air may be compared with those of plants in unfiltered air. In addition, plants are exposed to pollutants in special chambers under controlled environmental conditions to determine the mechanisms of the pollutants' actions. Major emphasis is placed on identifying pollutant-tolerant varieties of agronomic, vegetable, and ornamental plants.

Analytical Chemistry Laboratory

K. R. Hill, Leader

The Laboratory seeks new and improved methods for detecting and analyzing pesticide chemicals in soil, air, water, and agricultural products; and data on the distribution, dispersion, rates of disappearance, and breakdown products of pesticide chemicals.

Scientists here have pioneered in the development and use of selective phosphorus and sulfur detectors for gas and liquid chromatography, and the development of new techniques and apparatus for quantitative thin-layer chromatography. They have produced time-and money-saving procedures for residue analysis that are widely used throughout the world. In addition, they have collaborated with and supported other research chemists in elucidating the chemical structures of compounds important to agricultural research and farm productivity.

Biologically Active Natural Products Laboratory

M. Jacobson, Leader

Insect attractants, repellents, toxicants, anti-metabolites, and anti-fertility agents - these are some of the compounds that scientists are trying to isolate, identify, and synthesize from plant and animal sources. Various analogs and homologs of such compounds, as well as substances with possible juvenile-hormone effects, are synthesized.

Naturally occurring compounds having tumor-inhibiting properties of possible medical value are isolated, identified, and synthesized in cooperation with the National Cancer Institute. Another aspect of the program involves screening compounds electrophysiologically to determine their ability to attract or repell insects, part of a basic study on insect communication.

Biological Waste Management Laboratory

J. D. Menzies, Leader

Studies of the beneficial uses of sewage sludge on agricultural land are underway. Various methods of incorporating sludges into the soil to improve it are being investigated, along with resulting effects on soil, plants, and water.

Processing of animal manures for livestock feed is another area of work. Previous research established the nutritive value of poultry and other animal manures as feed supplements, particularly for ruminants. Scientists are now working to develop effective methods for pretreating and processing these wastes, as well as looking into possible hazards. Additional studies are directed at increased efficiency in producing insect larvae from poultry manure for use as a feed additive.

Emphasis is being placed on developing fertilizer and management practices to help revegetate strip-mined areas with useful forages.

Chemical and Biophysical Control Laboratory

M. S. Schechter, Leader

New chemical, biochemical, and biophysical methods of controlling insects are investigated. Photoperiodic effects on diapause (hibernation) of some of our most damaging agricultural insects are studied, so that these effects - or the underlying biochemical processes involved - can be used for insect control. Promising field-plot experiments using artificial illumination against insect diapause are being expanded.

New insecticides and new application techniques are being developed, in cooperation with other national and international agencies, to control insects dangerous to agriculture and public health on international aircraft flights and around airports. New physical and chemical methods are being investigated for control of flies affecting man and animals. Research is being conducted on feed-additive larvicides for fly control on livestock.

Chemicals Coordination Laboratory

S. A. Hall, Leader

A collection of over 30,000 organic compounds, which serves as a source for new insect-control chemicals, is maintained here. In cooperation with industrial laboratories and other ARS field laboratories throughout the United States, the search continues for effective insecticides with limited persistence that produce minimum adverse environmental effects to replace DDT and other undesirable chlorinated-hydrocarbon insecticides.

Insect Chemosterilants Laboratory

A. B. Borkovec, Leader

Scientists seek to find, and make available for use, chemical compounds that interfere with the fertility and reproductive capacity of insects and related organisms. They approach this objective by synthesizing or procuring model compounds, collecting data on their biological activity, and developing structure-activity relationships that serve as guides for further synthesis and selection of active chemosterilants. The chemistry and properties of the most effective compounds are investigated and made available for field tests.

Organic Chemical Synthesis Laboratory

Morton Beroza, Leader

Scientists here seek means of controlling injurious insects with chemicals other than conventional insecticides. A broad program is underway to synthesize and develop organic compounds useful as insect-control agents such as attractants, repellants, oviposition stimulants, and juvenile-hormone mimics. Relationships between molecular structure and biological activity are explored to guide the efforts at synthesis. Pheromones (attractants) and other chemicals controlling insect behavior are isolated, identified, and synthesized. For this purpose, new microanalytical methodology is developed. Formulations and technology needed to use sex pheromones in the direct control of insect pests such as the gypsy moth are being investigated intensively.

Pesticide Action Laboratory

J. L. Hilton, Leader

New scientific principles are being sought that may insure safe and effective use of chemicals used in the cultivation or control of plants

important to society. Ultimate objectives are to improve crop production, insure a high-quality food supply, and safeguard the environment.

Areas of study include: controlling narcotic plants; evaluating new herbicides; new uses for available chemicals in solving specific plant-pest problems; developing new methods of improving absorption, penetration, and movement of pesticides on or in plants; controlling the release of pesticides into the environment; elucidating biochemical and physiological responses of plants to pesticides and the fate of pesticides in plants; discovering the scientific principles underlying effective regulation of weed-seed germination and dormancy; and exploiting the principles of weed biology so as to obtain effective use of herbicides while reducing residues or other hazards.

Pesticide Degradation Laboratory

P. C. Kearney, Leader

Research is conducted here on the detection, movement, metabolism, photodecomposition, microbial metabolism, uptake, volatility and biomagnification of pesticides in soils and plants and in aquatic and animal systems. Work is done in cooperation with the Environmental Protection Agency and the Food and Drug Administration. Industry and foreign governments are consulted in establishing guidelines, new methods, and criteria for assessing pesticides in the environment. The staff includes biologists and chemists specializing in organic, biological, analytical, and soil chemistry and agronomists, plant physiologists, microbiologists, and animal scientists.

Physical Control Laboratory

L. A. Liljedahl, Leader

Better seedbed conditions and more effective fertilizer distribution are studied to reduce farm production costs and improve crop performance. New methods are developed for pesticide application to reduce the amounts of pesticide needed on crops and to limit drift. Instruments are developed to measure and control physical environmental factors. The spectral qualities of the light that triggers changes in plant and insect growth are investigated in laboratory and field studies. Nonchemical methods of controlling insects on livestock are devised and tested. New engineering processes are sought to permit cheap and efficient mass production of insects used in biological control programs.

The processes by which farmstead water supplies become contaminated are investigated. Better designs for new wells and methods of improving old wells are being developed.

AGRICULTURAL MARKETING RESEARCH INSTITUTE

E. E. Finney, Jr., Chairman
Rm. 130, Bldg. 003, (Admin. Bldg. ARC-W)
Phone: 344-3338

The Agricultural Marketing Research Institute conducts research to find ways of delivering farm products of high and uniform quality to consumers at minimum cost.

Agricultural production involves nearly 3 million farms scattered across the Nation. Many farm products are fragile and perishable and vary naturally in quality. The marketing system that brings this vast array of products together and puts them at the disposal of over 200 million American consumers is complex and expensive. About two-thirds of the consumer's food bill consists of marketing costs. Efficiency in the marketing of farm products is vital for agriculture and for the national economy.

Investigations by the Institute aim at solving technological and operational problems within the agricultural marketing system. Scientists and engineers of many disciplines study facilities, equipment, and techniques to improve the handling, processing, sorting, packaging, storage transportation, and distribution of agricultural products. Scientists also seek to improve the economic status of the American farmer by improving the domestic marketing system and expanding foreign markets.

Dairy and Poultry Products Laboratory

J. A. Hamann, Leader

This Laboratory works to develop improved facilities, equipment, and methods for processing, storing, and distributing dairy and poultry products. These studies are conducted mainly in selected plants in cooperation with industry. When new or modified facilities are needed, the type, size, location, and cost are determined; efficient plant and equipment layouts are developed; and work methods suitable for the new facilities are recommended.

Increasing effort is being directed toward assisting plant operators in meeting the stringent laws governing food processing. Guidelines and standards for efficient facilities and equipment are developed to assure acceptable performance and sanitary conditions that are required by regulations for wholesome food preparation, employee health and safety, and environmental protection.

Food Distribution Laboratory

K. H. Brasfield, Leader

Marketing facilities and methods for distributing food and other farm products are studied. The work includes the design, layout, location, and construction of necessary facilities and the development of marketing equipment and operating procedures.

The program emphasizes research and actual technical assistance in developing improved agricultural marketing facilities in cities, wholesale warehouses, retail outlets, and food service establishments. The goal is to increase overall efficiency in the distribution of farm products.

Horticultural Crops Marketing Laboratory

R. E. Hardenburg, Leader

Researchers are working to identify, measure, and protect desirable qualities in horticultural crops, from harvest to consumption, and to improve the equipment and facilities required to market these products. Objectives of these studies are to: Determine optimum environments for each commodity before processing or during storage, distribution, and display; Develop or evaluate new methods of measuring product quality; Reduce damage due to post-harvest diseases or other causes through temperature, chemicals, and other treatments; Develop improved packaging to protect quality and retard deterioration; Improve storage and packinghouse methods, equipment, and facilities; Promote more efficient fruit and vegetable wholesale marketing facilities in production areas.

The Laboratory cooperates with the Agricultural Marketing Service and other Federal agencies and with industry and State experiment stations. Technical services are provided to national fruit and vegetable organizations, producers, and others who transport or market fresh horticultural products.

Instrumentation Research Laboratory

Karl H. Norris, Leader

The Laboratory developes new and improved instruments and techniques for measuring the quality of a wide range of agricultural products - composition, texture, flavor, odor, color, and physical structure.

Techniques currently emphasized are light transmittance and reflectance for evaluating composition, and sonic-resonance techniques for evaluating texture. The Laboratory also develops instruments for measuring optical and sonic properties of agricultural products.

The researchers are engineers. Most of the work is done in cooperation with commodity specialists from other units of the Agricultural Marketing Research Institute

Livestock and Meat Marketing Laboratory

A. W. Kotula, Leader

Basic and applied research on beef, pork, poultry, lamb, and fish provides scientific data for USDA grading and inspection programs, so Department regulations can be evaluated continuously and revised as necessary. Scientists also seek to improve meat quality and reduce marketing costs by: Improving procedures for determining the quality of meat products; Developing more adequate means of measuring the quality of wool fiber; Controlling microbiological, physical, and chemical deterioration or contamination of meat; Improving facilities for marketing livestock and for marketing meat products.

The work is carried out at Beltsville and at meat marketing centers throughout the country in cooperation with industry. Additional studies are undertaken by cooperative agreement with State experiment stations and PL 480 grants to foreign scientists.

Market Operations Laboratory

J. C. Bouma, Leader

Research concerns improved handling of all agricultural products as they move from farms to consumers. The main objective is to rearrange, combine, or otherwise modify agricultural marketing processes to increase efficiency and decrease costs. Examples of current investigations are: Cost and quality comparisons of shipping broilers ice packed or chill packed from processing plant to retail store; determining whether to cut up the broilers at the processing plant or at the wholesale or retail level. Cost and feasibility of transporting citrus fruit in bulk cars compared with shipment as unitized and hand-stacked loads; determining the most efficient place for packaging citrus in consumer-sale units.

This research involves scientists working in a broad range of disciplines - engineering, mathematics, economics, statistical analysis, and marketing to provide technical and engineering assistance to industry in the planning of food marketing facilities.

Post-Harvest Plant Physiology Laboratory

M. Lieberman, Leader

The overall mission of the Laboratory is to develop basic information that will contribute to better understanding of aging and senescence of flowers, fruit, vegetables, and seeds after harvest. This information is needed to develop improved methods for transportation, storage, and handling of perishable agricultural products.

The post-harvest physiology and biochemistry of fruits, vegetables, and seeds are studied. The mode of action of ethylene is being studied to clarify the interaction of this substance with other plant hormones in growth, development, aging, and senescence. Plant tissues are studied with the electron microscope to detect changes in intracellular organelles that may be associated with senescence. Changes in acid phosphatases and other enzymes associated with senescence also are studied in aging cells. Investigations seek to establish the fundamental physiological and biochemical bases for vigorous seed growth and development.

Seed Quality Laboratory

L. W. Woodstock, Leader

Conducts basic and applied research on germination, vigor, dormancy, storability, pathology, and variety of seeds. The main thrust of the work is toward improved methods and equipment for determining seed quality. Marketing of seeds is based on quality and must comply with Federal and State legislation.

Other major efforts include the development of methods for predicting the storage potential of seeds, and to understand the basic causes of seed quality deterioration.

Research on oilseeds and cereals includes: Detecting any vegetable proteins that might be added to meat products; determining the effect of storage practicies on development of molds and aflatoxins in cottonseed and developing methods of detecting them; development of methods for evaluating the market quality of oilseeds and oilseed products, and the effect of natural antioxidants on vegetable oils.

Transportation and Packaging Research Laboratory

P. L. Breakiron, Acting Leader

Scientists conduct research to improve the efficiency of moving farm and food products to both domestic and foreign markets - by improving transportation equipment, techniques, and services. Packaging specialists develop, test, and evaluate improved packages, packing materials, and

shipping containers for agricultural products in order to reduce marketing costs and solid wastes from packaging. Their work includes research to develop standard size packages, shipping containers and unit loads. They also develop and evaluate improved transport vehicles, including van containers, for shipping perishable and non-perishable commodities by land, sea, and air. The research also seeks more effective methods of using transport equipment and services through improved loading, refrigeration, and cargo securing methods to improve the transportation environment for the products and reduce transportation and related handling costs.

ANIMAL PARASITOLOGY INSTITUTE

F. D. Enzie, Chairman
Rm. 100, Bldg. 104, (Animal Parasitology Bldg. ARC-E)
Phone: 344-2201

This Institute is a national center whose prime objective is to prevent or eradicate parasitic infections in livestock and poultry in order to reduce the economic losses from them. Parasitologists, veterinarians, chemists, and other scientists in the Institute's four main laboratories cooperate to achieve this goal.

Institute personnel prepare and maintain two internationally known tools used by parasitologists everywhere - the Index Catalogue of Medical and Veterinary Zoology and the National Parasite Collection. Both are valuable in studies of parasitism in livestock, poultry, man, and wildlife. They are indispensable in efforts to develop parasite control programs and to prevent exotic species from gaining a foothold in this country.

The Institute occupies 400 acres at Beltsville. Because of the hazard of parasite contamination, strict security is maintained.

Haemoprotozoan Diseases Laboratory

T. O. Roby, Leader

Protozoan blood parasites that cause disease in animals are the target of research by this Laboratory. The parasites are transmitted primarily by anthropod vectors. Two important blood diseases presently under study are anaplasmosis of cattle and babesiosis (piroplasmosis)of horses. Scientists are investigating means of improving diagnostic methods, treatment, and control of these diseases.

Histoprotozoan Diseases Laboratory

D. J. Doran, Leader

Better methods for treating and controlling histoprotozoan diseases in poultry and other farm animals are being developed. Primary investigations are on coccidiosis in poultry and sheep and histomoniasis of turkeys and other gallinaceous birds. All phases of the life cycle of the parasite that causes coccidiosis are under study as are the effects of drugs of known or potential value for controlling the disease. Similar research is being carried out on histomoniasis.

Ruminant Helminthic Diseases Laboratory

H. Herlich, Leader

Research here is designed to improve present methods and develop new measures for control of helminthic diseases in cattle, sheep, and goats. Current work is directed at nematodes in the gastrointestinal tract. These parasites cause the greatest economic loss to the livestock industry. By monitoring changes in the blood chemistry and tissues of host animals, scientists can study how these nematodes produce their pathogenic effects. Through studies of host specificity and immunity and tests of promising chemical compounds, scientists hope to develop effective parasite control measures.

Non-Ruminant Helminthic Diseases Laboratory

F. G. Tromba, Leader

The biological control of ascariasis and stephanuriasis, diseases that cause major economic losses in swine, is one of the many programs at this Laboratory for the detection, prevention, and control of helminths that parasitize swine and other non-ruminant animals. A prine objective is the development of a reliable test for detecting trichina larvae, parasites of swine that cause trichinosis in man. Basic studies on nematode physiology and work to control animal nematodes by vaccines and other biological methods also are in progress.

Index-Catalogue of Medical and Veterinary Zoology

Judith M. Humphrey, In Charge

This compendium of the world's literature on parasitology was established in 1892. It consists of an author catalogue and four parasite-subject catalogues. Over 100 publications have been issued to disseminate the information to the scientific community. They include volumes on special subjects such as "Parasites of Deer" or "Ticks and Tick-Borne Diseases". These publications have worldwide distribution. Medical and veterinary scientists come to Beltsville from all over the world to use the Index-Catalogue to obtain information about particular problems in parasitology.

National Parasite Collection

J. R. Lichtenfels, Curator

This is one of the world's largest collections of animal parasites. It includes some 65,000 parasite lots, each consisting of one or many specimens. New lots of parasites are regularly submitted by U.S. scientists. Specimens from the collection are constantly on loan to parasitologists throughout the world since they provide invaluable aids in studies of parasite taxonomy and systematics.

ANIMAL PHYSIOLOGY AND GENETICS INSTITUTE

J. W. Smith, Chairman
Rm. 21, Bldg. 265, (Poultry Admin. Bldg. ARC-E)
Phone: 344-2056

Solving animal production problems, and thereby increasing the benefits man derives from livestock, is the purpose of this Institute. Areas of work include dairy production research, with emphasis on genetics, reproductive physiology, udder health, and management; swine reproductive physiology and genetics; avian physiology, emphasizing improved reproduction and oncogenetics; biochemical research to determine the consequence of environmental contaminants and to evaluate methods of improving the biochemical properties of animal products; and operation of the U.S. Department of Agriculture's Animal Improvement Programs affecting dairy cattle, chickens, and turkeys throughout the country.

Animal Improvement Programs Laboratory

F. N. Dickenson, Leader

Nationwide livestock performance-testing programs provide data that enable scientists to improve methods of estimating the genetic transmitting ability of farm animals. Personnel of this Laboratory operate the National Dairy Sire and Cow Genetic Evaluation Programs and the National Poultry and Turkey Improvement Plans. They also coordinate the National Cooperative Dairy Herd Improvement Plan.

Animal Operations Unit

N. W. Hooven, Leader

This staff provides animal services, facilities, and technical assistance to scientists at Beltsville working with dairy cattle, poultry, and swine. The Unit assigns animals to new projects at the request of researchers and provides and maintains equipment needed to support animal science projects. In addition, the staff manages crop and pasture land for Beltsville livestock according to the needs of the various animal research laboratories.

Avian Physiology Laboratory

L. B. Crittenden, Leader

Scientists conduct research on the physiological and endocrine factors that control reproductive efficiency in turkeys and chickens. This work includes studies of neuroendocrinology and semen preservation. The Laboratory also seeks to control lymphoid leukosis through genetic selection of chickens and through better understanding of the interaction of viral and host genes of this disease.

Biochemistry Laboratory

J. Bitman, Leader

Reducing the proportion of saturated fats in milk and identifying how agricultural and industrial pollutants affect livestock and poultry are subjects of major concern here. Emphasis in this research is on biochemical factors involved in milk-fat synthesis, alteration of polyunsaturated fats in milk, and effects of pesticides and other chemicals on animal reproduction.

Genetics and Management Laboratory

R. H. Miller, Leader

Studies of basic swine genetics are aimed at developing more profitable swine for producers with more desirable carcasses for consumers.

Dairy cattle genetics and management is concerned with breeding systems and criteria for selecting superior milk producers, group feeding of blended diets, self-feeding silage systems for heifers, and the value of machine stripping in the milking process. Current research on mastitis covers techniques for detection and prevention of the infection, physiological defense mechanisms, genetic resistance of the cows, and effects of milking methods. The Laboratory also is developing new identification systems for dairy and beef cattle and for swine.

Reproduction Laboratory

H. W. Hawk, Leader

The livestock industry would benefit greatly from improved reproductive efficiency in farm animals - the main goal of work at this Laboratory. Of particular concern are regulation of estrus and ovulation, improved fertilization of ova, and fewer embryonic deaths. Basic studies are being conducted on preservation of boar semen, sperm cell transport in the female, and the role of immune responses in reproduction.

INSECT IDENTIFICATION AND BENEFICIAL INSECT INTRODUCTION INSTITUTE

R. I. Sailer, Chairman
Rm. 1, Bldg. 003, (Admin. Bldg. ARC-W)
Phone: 344-3182

Insects cost American Farmers and consumers millions of dollars annually in food and other products. This Institute is devoted mainly to identification of insects and the discovery of foreign insect species that show promise for use in biological control of domestic insect pests and weeds. Entomologists estimate that there are at least two million insect species that have never been identified. Scientists conduct field surveys in this country and abroad to fill this knowledge gap.

The Institute scientists have as their principal working tool the Smithsonian Institution's National Insect Collection. This is the world's second largest collection of preserved insect specimens and other reference sources.

The Institute coordinates research by scientists in the United States and abroad relating to the introduction of beneficial insects. Results of these studies will help to develop improved pest-control methods, more effective environmental and farm management practices, and better conventional, biological, or bio-chemical approaches to pest control.

The staff is divided between two laboratories with headquarters at Beltsville. Some scientists are stationed in the National Museum of Natural History, Washington, D.C.

Systematic Entomology Laboratory

R. H. Foote, Leader

This Laboratory is concerned with the classification and identification of insects and mites. Scientists also study new methods of recognizing various species of insects and mites and sorting them into appropriate, related groups. They determine the geographic and seasonal distribution of these insects and mites and their sources of food and shelter.

Significant physical and biological characteristics of insects and mites are studied intensively and used to develop basic reference publications. This research makes possible the precise enumeration and recognition of North American insects and mites and of those native to other parts of the world.

The Laboratory also identifies insects to assist the extension, and control activities of other Federal and State agencies and other organizations in the United States and abroad.

Beneficial Insect Introduction Laboratory

J. R. Coulson, Leader

This Laboratory coordinates research involving the importation, colonization, and evaluation of beneficial foreign insects. It maintains a center where records are kept of all beneficial insects, mites, and other arthropods that are imported into the United States by Federal, State, or other agencies. Records also are kept on beneficial foreign insects successfully colonized in the United States.

Staff members help evaluate the results of introductions of beneficial insects and distribute state-of-the-art summaries, progress reports, and bulletins for use of regional and local investigators and pest control workers.

NUTRITION INSTITUTE

W. Mertz, Chairman
Rm. 226, Bldg. 308, (North Lab, ARC-E)
Phone: 344-2160

The Nutrition Institute is concerned with establishing human and animal requirements for energy, protein, carbohydrate, lipids, vitamins, and minerals. It also conducts investigations to determine the nutritional qualities of foods, including composition, biological interactions, and the availability of macronutrients and micronutrients in foods.

Carbohydrate Nutrition Laboratory

D. L. Trout, Leader

The functions and roles of various dietary carbohydrates in human biology are determined. The program is concerned particularly with learning how to identify children and young adults who must control their intake of carbohydrate to avoid or postpone health problems.

Part of the research deals directly with human subjects fed experimental diets under controlled conditions. Another part uses experimental animals to explore the effects of diet on the development of atherosclerosis and other degenerative diseases. The research goal is to develop a basis for recommendations on carbohydrate intake by certain individuals.

Dairy Foods Nutrition Laboratory

J. A. Alford, Leader

To develop basic knowledge on the functional and nutritional properties of dairy foods, determine the influence of processing on these properties, and apply this knowledge to produce new and improved products, are the aim of this Laboratory. Scientists study the uses of whey and whey fractions; improvement in the rate of flavor development in natural and low-fat cheeses; control of pathogens in dairy products; and control of vitamins, minerals, and amino acids in dairy foods by changes in processing methods.

Lipid Nutrition Laboratory

J. M. Iacono, Leader

Scientists study man's dietary requirements for fats. They determine the amount and kinds of fat needed in the diet to promote health, and they investigate foods that meet these needs. Research concerns the metabolism of dietary fats in man and in experimental animals, and the role of dietary fat in cardiovascular diseases and thromboses.

Non-Ruminant Animal Nutrition Laboratory

L. T. Frobish, Leader

The objective is to improve the use of feed by non-ruminants, particularly swine and turkeys. Research on swine nutrition emphasizes investigation of the effects of energy and protein intake on reproductive performance; use of carbohydrates by fetal and newborn pigs; interactions of genetic and nutritional factors in swine; and the metabolizable energy value and availability of amino acids in feedstuffs.

Turkey research involves investigations of the effects of nutrients on reproduction; effects of protein and energy on growth and carcass composition; amino-acid requirements for turkey growth and reproduction; and the energy and amino acids provided by feeds.

Nutritional Microbiology Laboratory

L. L. Slyter, Leader

This Laboratory concentrates on basic studies of the symbiotic (compatible) relationship between intestinal microorganisms and their host animals, particularly ruminants. The research is intended to show how intestinal microorganisms in livestock can be influenced or changed to improve animal nutrition and health.

Protein Nutrition Laboratory

D. A. Vaughan, Leader

Scientists determine human dietary requirements for proteins and amino acids and recommend foods to meet these requirements. They characterize the chemical nature, properties, and nutritional usefulness of food proteins, and learn how they are used by the body.

The distribution, nature, properties, and composition of proteins in foods are investigated. Processing methods are tested for their effects on the nutritional availability of amino acids. Methods are developed to chemically identify amino acids in foods. Scientists also study the effects of type and level of dietary protein on body processes, such as growth and aging, and the effects of heredity on use of proteins.

Ruminant Nutrition Laboratory

R. R. Oltjen, Leader

Nutrition studies are aimed toward improving the efficiency of beef cattle, dairy cattle, and sheep in converting feeds into meat, milk, and wool. Much of the research is basic, but the new information developed is tested in practical situations.

A major concern is to make ruminants less competitive with humans and other animals for available food supplies.

Subjects currently under investigation include residue hazards of diethylstilbestrol; use of nonprotein nitrogen; effects of feeding "Protected" polyunsaturated fat; nutritional value of forages and plant wates; preservatives for silage; and dietary requirements and toxic effects of minerals.

Vitamin and Mineral Nutrition Laboratory

E. W. Toepfer, Acting Leader

Research concerns the function of vitamins and minerals in development, growth, and health of humans and animals. Procedures are developed to measure small amounts of these nutrients and to estimate their biological availability from different sources. For example, scientists found that iron in wheat is highly available compared to iron in egg yolk because of the difference in molecular structure of the naturally occurring iron compounds in the two foods.

The Laboratory also investigates dietary requirements for chromium and selenium. The biologically active form of chromium in foods is being isolated. The function of vitamin E and its possible relationship to selenium are being studied. Research is being planned on various other trace elements, including zinc, tin, vanadium, and nickel.

PLANT GENETICS AND GERMPLASM INSTITUTE

J. G. Moseman, Chairman
Rm. 127, Bldg. 001, (South Bldg. ARC-W)
Phone: 344-3235

This Institute is responsible for research on genetic methods for improving many field crops, fruits, vegetables, and ornamental plants. Scientists travel worldwide to collect plants and seed which are required for developing improved varieties of farm and nursery crops. Collected plants are grown under quarantine, where their characteristics and suitability for this country can be studied. Stock of selected plants are then maintained at various locations and distributed to scientists for further research. The Institute's collections of live plant materials - called "germplasm" by crop scientists - is the largest in the world.

Geneticists, plant pathologists, entomologists, plant physiologists, and chemists work in a team approach to evaluate and improve plants. The new plants developed are released either as improved germplasm or as new varieties.

Germplasm Resources Laboratory

G. A. White, Leader

In cooperation with other groups, the scientists coordinate the procurement, documentation, distribution, evaluation, and preservation of germplasm. This work eventually leads to development of the most promising species as new crops.

A small Grain Collection of more than 55,000 plants is maintained at Beltsville. The Laboratory is also responsible for the International Wheat and Oat Rust Nurseries in the United States and other countries.

Medicinal Plant Resources Laboratory

R. E. Perdue, Leader

The staff procures plants from various parts of the world for chemical and biological screening. The main effort is focused on a search for plants which possess new drugs for treating cancer. Other programs include screening plants for chemically unique seed oils and proteins, antimalarial agents and antimetabolites. New sources are explored for other useful chemical agents in plants, as well as for plants that could provide useful chemical constituents not now available.

Plant Taxonomy Laboratory

J. A. Duke, Leader

These scientists identify and provide correct names for plants important to agriculture. Economically valuable plants are studied in the field, the herbarium, and the library. The Laboratory houses one of the largest seed collections in the world, a large collection of narcotic species, and a growing file to provide recommendations of alternative crops for countries that wish to phase out narcotic plants. Major research thrusts are on narcotic poppy species (source of opiates), the coca plant (source of cocaine), and grasses and legumes.

Applied Plant Genetics Laboratory

C. H. Hanson, Leader

Scientists are improving alfalfa, barley, peanuts, rice, and sugarbeets. Through genetic studies, they are incorporating resistance to diseases, insect pests and even to air pollution. The following are the objectives in research on major crops: Alfalfa; Resistance to alfalfa weevils, anthracnose, and other insects and diseases. Sugarbeets; Improved processing qualities, combined resistance to leaf spot and black root, and other desirable qualities. Peanuts; Rust resistance, ways to break dormancy of seed, early maturity, high-yielding varieties of the Spanish type. Rice; Tolerance to low temperatures in the seedling stage and maintenance of 10,000 varieties in a World Collection for use by scientists.

Tobacco Laboratory

T. C. Tso, Leader

Findings of this Laboratory are applicable to many crops other than tobacco. Major research activities include: Isolating and identifying factors related to leaf quality and usability, and developing safer tobacco; Identifying sources of disease resistance, and incorporating this resistance into breeding lines; Determining the causes of physiological disorders, and mechanisms of tolerance and control in plants; and conducting research on tobacco genetics, biochemistry, and metabolism affecting plant growth and leaf composition.

Turfgrass Laboratory

D. L. Klingman, Leader

Major objectives are to improve turfgrass species and to develop better management systems for turfgrasses grown under different conditions. This research includes work on grasses for home lawns, roadsides, cemeteries, airports, parks, playgrounds, and golf courses. Grasses studied include Kentucky bluegrass, fescues, bermudagrass and zoysia.

Fruit Laboratory

M. Faust, Leader

New varieties of pears, peaches, grapes, blueberries, and strawberries are being developed. Research on these fruits is directed toward increasing disease resistance, superior horticultural and fruit characteristics in new varieties and breeding lines.

Scientists working in fruit physiology are seeking to determine the role of calcium in fruit quality. They also are studying juvenility in trees and have developed methods of hastening maturation of trees which result in earlier fruit production.

Fruit pathology studies are conducted on bacterial diseases of pears and peaches and on bacteriophages - useful viruses that parasitize and destroy disease-causing bacteria.

Vegetable Laboratory

R. E. Webb, Leader

Major vegetable crops are studied in relation to resistance to pests; improved yields; better nutritional, marketing, and processing qualities; and adaptation of vegetables to various farming conditions and areas. Plant breeding is developing new tomato varieties adapted to mechanical harvesting, new potatoes suited for fresh market or processing, and improved mushroom spawn to increase the efficiency of mushroom production. Other projects involve pepper, spinach, eggplant, and the curcubits - squash, pumpkins, watermelon, and cucumbers.

Scientists are seeking effective, integrated control of vegetable pests by using plant resistance along with crop management practices, plus selected chemicals when needed. They are determining the minimum amounts of pesticides required under various management conditions for economical control of specific pests of vegetables.

Ornamentals Laboratory

H. M. Cathey, Leader

Research aids growers and home gardeners in the culture, breeding, and protection of cut flowers, ornamental trees, shrubs, ground covers, annuals, and container-grown plants. Ornamental plants tolerant to air pollution and resistant to diseases and insects are identified and developed.

New lines of roses, poinsettias, rhododendron, geranium, New Guinea Impatiens, camellia, statice, orchids, and Caenothus are being developed. Other studies are determining the potential for giving plants a head start in development, by growing cells or seedlings under controlled conditions that accelerate their growth. Manipulation of plant pigments and color are being studied in tests with 26 naturally occurring compounds that combine with anthocyanins to stabilize or alter the color of red and blue fruit and flowers.

Mutations and virus-free plants for use in basic research are objectives of other research projects. Effects of efficient new light sources on the growth and development of plants are being studied in conjunction with growth-regulating chemicals, which modify flowering size, and other plant characteristics.

PLANT PHYSIOLOGY INSTITUTE

H. R. Carns, Chairman
Rm. 217, Bldg. 001, (South Bldg. ARC-W)
Phone: 344-3036

The overall objective is to develop plants better adapted to their environments that will produce greater amounts of better quality food, feed, or fiber, or have more attractive ornamental values. The Institute is pursuing this objective by - determining how plants respond to environmental stresses; establishing their needs for optimum growth and development; developing means to minimize the effects of unfavorable conditions; discovering the interactions among plants, diseases, pests, and the environment; identifying germplasm with resistance to pests and to stress, and evaluating plants and cultural practices as tools in managing the hydrologic response of agricultural watersheds.

Six Laboratories have been established to study the soils, air, light, water, temperature, and related environmental conditions affecting plant growth. Studies are conducted under both optimal and stressed growing conditions, to discover the physiological and biochemical mechanisms involved.

Plant Stress Laboratory

M. N. Christiansen, Leader

Plant stress research has two main objectives - determining the results of environmental stress on plant processes, and developing methods for improving the plant's ability to withstand and recover from such stress. Plants are subjected to heat, cold, drought, toxic minerals, and oxygen or nutrient deficiencies, to determine the environmental limits of plant functions. Scientists also attempt to modify plants by genetic, chemical, and cultural methods to increase their tolerance to adversity.

Research on plant stress ultimately will improve the environmental adaptability of food and fiber crops, thus reducing farm losses due to environmental extremes and increasing land area suited to production of some crops.

Plant Nutrition Laboratory

R. C. Leffel, Leader

Fertilizer nitrogen must be applied to soils to achieve maximum crop yields with minimum hazard from nitrate pollution. Research aims at discovering the fate of nitrogen remaining in the soil. It includes studies on transformation of inorganic nitrogen into soil organic forms, the rate at which labeled organic nitrogen is mineralized by microorganisms and becomes mobile again, and losses in different soils by denitrification.

Research on soybean rhizobiology aims to increase nitrogen fixation, and thus seed yield, by the soybean plant. In research on soybean breeding, a concept for improving a base population of homozygous lines through recurrent selection and intermating is being tested. Improved full-season cultivars for the Middle Atlantic area also are being developed.

Light and Plant Growth Laboratory

G. E. Carlson, Leader

The goal is to realize the full yield potential of plants by improving their response to light and other environmental factors. This goal is sought through improved methods for measuring and controlling environmental factors that affect plant growth, and by determining their affect on physiologic, morphologic, and biochemical responses of plants. Plants and portions of plants such as leaves, tissues, and cells are grown in controlled and natural environments, and photosynthesis, translocation, respiration, flowering tiller development, and other

physiologic and biochemical processes are observed. As a result, specific selection criteria for increasing yield and quality can be developed. Physical parameters are determined for the design of controlled-environment facilities for plant research and production.

Plant Hormone and Regulator Laboratory

J. W. Mitchell, Leader

Scientists are discovering new hormones in plants, isolating these substances, and attempting to use them in crop production. Natural growth-regulating substances, rather than synthetically prepared ones, are studied for control of plant growth and behavior. Research is also directed toward the production of nontoxic, readily degradable growth-regulating substances that can be used to advantage on crop plants. Improved methods of propagating plants, by using hormones that control regeneration processes, are also under study.

Hydrograph Laboratory

H. N. Holtan, Leader

The hydrologic records of ARS and other agencies are analyzed to develop mathematical models for predicting plant use of rainfall, storage of water in the soil, groundwater recharge, and streamflow on agricultural watersheds. Particular emphasis is given to the paths of flow from upland areas to the watershed outlet. Overland flow and subsurface return flow are computed to predict movement of agricultural chemicals. The Laboratory is determining how land use affects disposition of excess water on the surface and subsurface flow, and how these factors influence the choice of farm chemicals and their placement. Emphasis is given also to developing techniques for predicting volumes and velocities of streamflow as potential vehicles for sediment transport. Models developed are field tested in cooperation with ARS field stations throughout the country.

Hydrologic Data Center

J. B. Burford, Leader

Hydrology research is being conducted by ARS on about 325 watersheds distributed among 27 different locations throughout the country. Data from these studies are submitted to this Data Center for annual publications and data bank storage. The work involved editing and preparing for publication hydrologic data summaries from field locations; developing and maintaining a computerized system for preparing these publications; cataloging, evaluating, and storing research data; and handling special data requests for hydrologic information.

PLANT PROTECTION INSTITUTE

J. P. Meiners, Chairman
Rm. 216, Bldg. 004, (Admin. North Wing, ARC-W)
Phone: 344-3600

This Institute, composed of nine Laboratories, conducts basic and applied studies to reduce crop losses by controlling pests and diseases of plants and bees. Areas of research are: Physiology, biochemistry, and diseases of plants; viruses and soilborne diseases of plants; and identification and naming of fungi and nematodes.

Practical research seeks to control insects, diseases, and nematodes through biological, chemical, and crop-management methods, and through breeding crops that are resistant to damage.

Research on honey bees includes study of environmental factors affecting pollination of crops and production of honey and beeswax.

Chemical and biological methods of controlling pests affecting man and animals are being studied.

Applied Plant Pathology Laboratory

C. A. Thomas, Leader

This Laboratory is concerned with fungal, viral, and bacterial diseases of lima beans, snap beans, soybeans, sugarcane, sweet sorghum, sunflower, and safflower. The research includes studies on causes of plant diseases, disease epidemics, genetics of plant resistance to diseases, and methods of disease control. Major projects include studies of legume and sugarcane viruses and mildew of lima beans. The Laboratory publishes the Plant Disease Reporter, a journal of international importance for agricultural research.

Bioenvironmental Bee Laboratory

A. S. Michael, Leader

Research centers on factors in the environment that affect the number of honey bees needed to pollinate crops and to produce honey and beeswax. Included are studies on: Air, water, and plant pollutants, including pesticides; Diseases and pests of honey bees; Nutrition of honey bees, particularly in relation to weather and availability of food. A diagnostic

service is provided for beekeepers and apiary inspectors. Glass observation hives are maintained for research and for the information of visitors. One of the world's most extensive libraries on bees is maintained in the Laboratory by the National Agricultural Library.

Biological Evaluation of Chemicals Laboratory

R. E. Redfern, Leader

Experimental chemicals are tested for their potential as insecticides, insect repellents or attractants, juvenile hormones, or chemosterilants. Experimental compounds are evaluated against various species of insects, including laboratory colonies of flies and roaches that are resistant to some commercial insecticides. Insecticide chemicals and formulations are recommended to the Armed Forces, U.S. Public Health Service, and other agencies.

To carry out its diverse research activities, the Laboratory maintains large colonies of houseflies, face flies, mosquitoes, several species of cockroaches, the large milkweed bug, fall armyworm, confused flour beetle, and yellow mealworm.

Insect Pathology Laboratory

A. M. Heimpel, Leader

Scientists are engaged in basic and applied research with micro-organisms that cause diseases in insects. Their studies involve the isolation and identification of infectious agents and the biochemistry, nutrition, genetic variability, and mode of action of bacteria, protozoa, nematodes, viruses, and fungi that attack insects. In this work, studies of a pathogen-host relationship may be followed by research to develop methods for using micro-organisms in the control of insects. Preliminary experiments are conducted on the production, formulation, and safety of microbial agents for biological control of insects.

Insect Physiology Laboratory

W. E. Robbins, Leader

Scientists study the normal biochemical processes in the organs, tissues, and cells of insects, with special emphasis on chemicals found in nature, that regulate growth, development, reproduction, and behavior of insects. Such chemicals include insect hormones and attractants, essential nutrients, and substances in plants that affect an insect's choice of host plants or make a plant resistant to insects.

Researchers isolate these chemicals from insect or plant sources, determine their structures, and synthesize them in the laboratory. Similar chemicals also are synthesized, to determine if they are more active than or if they interfere with the action of natural chemicals. Such chemicals are tested for use in pest control.

Mycology Laboratory

P. L. Lentz, Leader

"All about fungus organisms" describes this work. Scientists are concerned with fungi that cause diseases of useful plants and animals; fungi that control the growth of harmful and noxious plants; mushrooms that affect soil fertility, poison people, or cause hallucinations; molds that destroy useful products and those that form life-saving substances such as penicillin; yeasts that kill plants and insects and those that produce vitamins and alcohol.

The Laboratory makes information available from the world's largest collection of preserved specimens of fungi, and from data collections that include practically everything known about fungi.

Plant Nematology Laboratory

J. M. Good, Leader

Scientists identify and investigate the biology and control of nematodes (species of roundworms) that are pests of plants or are parasites of insects. Chemical and biological controls and crop-management practices that help to control nematodes also are studied. The objective is to reduce crop losses caused by nematodes that exceed $1 billion annually.

Studies involve plant resistance to nematodes, natural enemies of these pests, evaluation of new and safe chemical compounds for controlling nematodes, and basic research on nematode biochemistry. The Laboratory maintains one of the world's largest collections of literature on nematodes and collections of hundreds of type specimens. These collections provide information needed to establish causes of crop losses, distribution of nematode species, and quarantines that can prevent the spread of nematodes.

Plant Virology Laboratory

R. L. Steere, Leader

Basic research is conducted on plant viruses and diseases once thought to be caused by viruses. Examples of the latter include mycoplasmalike organisms, rickettsialike organisms and viroids. Biochemical activities are explored in virus particles, including satellite viruses (which can

reproduce only in plants already infected by another virus). Other aspects of research are the biochemistry and structure of viroids and the isolation of additional viroids - including attempts to determine whether viroids cause certain animal diseases.

Scientists also are developing new techniques, such as freeze etching, to prepare viruses for study with the electron microscope, an instrument which can magnify specimens more than 30,000 times.

Soilborne Diseases Laboratory

G. V. Papvizas, Leader

Research is conducted to: Develop new methods to determine the kinds and numbers of micro-organisms in soils; their interrelations with different kinds of soil, with organic matter, and with crops; and the incidence and severity of soilborne plant diseases. Determine micro-ecological factors responsible for the behavior and survival of root-infecting micro-organisms. Develop economically feasible methods for biological control. Minimize the need for chemical control of soiborne diseases by combining chemical treatment with various crop-management practices. Test practices include modified use of fertilizer, different dates for planting or harvesting, use of pest-free seed, appropriate irrigation procedures, and use of decoy crops.

COOPERATIVE FARM BUILDING PLAN EXCHANGE AND RURAL HOUSING

Merrill S. Timmons, Leader
Bldg. 228, Agricultural Engineering Office
Phone: 344-2121

These specialists work closely with the four regions and other Federal, State, and private groups to advance planning of farm buildings. They conduct housing research to improve plans for rural homes. Final plans are available through the Land Grant Universities and Extension Service.

OTHER ACTIVITIES AT THE AGRICULTURAL RESEARCH CENTER

National Program Staff

The National Program Staff was established to assure that the ARS research program remains nationally oriented even though personnel and financial resources are allocated on a regional basis. The staff consists of 42 subject matter specialists in livestock, veterinary, marketing, nutrition, engineering, entomology, plant, and soil. water and air sciences. The group serves as advisors to researchers and administrators in developing policy and program, and in making reviews and evaluations.

To assist the scientists nationwide in maintaining high-quality reporting and coordination of information exchange, ten National Technical Editors are attached to the National Program Staff. The staff also includes an executive letter writing group that responds to congressional correspondence to assure adequate liaison between the executive and legislative branches of government.

Program Analysis and Coordination Staff

This staff is responsible for providing for retrieval of information on funding, scientist resource allocation, and progress of the separate aspects of the overall research program. They assist in maintaining a proper balance of emphasis and a proper priority for initiation of new research.

Northeastern Regional Office

In order to be responsive to regional research needs, the program of the Agricultural Research Service was divided into four geographic units. The Deputy Administrator for the Northeastern Region, Dr. Steven C. King, has the major responsibility for the implementation and operation of the research program. He also is responsible for maintaining close liaison with action agencies such as the Soil Conservation Service and Extension Service who use research information, and with the State Agricultural Experiment Stations to insure that the research programs are complementary. Administrative Services; information; program planning development, and evaluation; and biometrical service support are provided at the regional level.

The National Agricultural Library

A 15-story tower and adjacent two-story wing houses the National Agricultural Library -- one of the three national libraries in the United States, and the most modern library facility in the world that specializes in agriculture. The library has assembled a collection of over 1.5 million volumes. NAL is engaged in a long-range program of building a responsive information system. Programs are designed to serve and support the rapidly changing and expanding interests of the national and international agricultural communities.

Other USDA Agencies

Other agencies of the USDA represented at the Center are the Agricultural Marketing Service, Forest Service, and Soil Conservation Service.